Liberty and Lethality: Integrating MC-12W Liberty and Light Attack/Armed Reconnaissance Aircraft Operations

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14. ABSTRACT

In April 2008, the United States Air Force began procuring thirty-seven MC-12W Liberty aircraft to augment existing intelligence, surveillance, and reconnaissance systems already operating in the United States Central Command's area of responsibility. In addition to the MC-12W, the USAF is also preparing to field a Light Attack/Armed Reconnaissance aircraft. Both aircraft are technically capable of performing Intelligence Surveillance and Reconnaissance and Forward Air Controller-Airborne missions, but there are no current plans for the aircraft to share these mission areas.

This study utilizes a document review to answer the question; can the MC-12W Liberty and Light Attack/Armed Reconnaissance aircraft perform common roles and missions while integrating operations, in order to maximize their support to COIN operations? The study also provides conclusions and recommendations for future MC-12W and Light Attack/Armed Reconnaissance aircraft integration.

The study author argues that these two weapons systems are not interchangeable. Individual aircraft designs, aircrew-training programs, and organizational constructs result in two unique weapon systems optimized for different roles and missions. Despite these limitations, the two aircraft could operate in multi-aircraft packages. In order to achieve this level of integration, the USAF will have to make changes in the MC-12W Liberty manning, training, and deployment constructs.

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Abstract

LIBERTY AND LETHALITY: INTEGRATING MC-12W LIBERTY AND LIGHT ATTACK/ARMED RECONNAISSANCE AIRCRAFT OPERATIONS by Major Steven J. Tittel, United States Air Force, 53 pages.

Responding to comments made by the Secretary of Defense in April 2008, the United States Air Force began procuring thirty-seven C-12 class aircraft to augment existing intelligence, surveillance, and reconnaissance systems already operating in the United States Central Command's area of responsibility. However, this effort did not mark the beginning of studies directed at employing off-the-self, mission specialized aircraft for conducting counterinsurgency (COIN) operations. In addition to the MC-12W Liberty aircraft, the USAF was also studying a project designed to provide low cost air support to forces engaged in counterinsurgency operations. The Air Force called this project the Observation/Attack-X or Light Attack/Armed Reconnaissance aircraft. Due to similar performance, electro-optical, infrared, imagery collection, and communication reach-back capabilities, these aircraft are both technically capable of performing Intelligence Surveillance and Reconnaissance and Forward Air Controller-Airborne missions, but there are no current plans for the aircraft to share these mission areas.

This study utilizes government requests for information, contracting data, capabilities and need statements, service memoranda, contractor produced publications, flight manuals, training programs, and doctrinal publications to answer the question; can the MC-12W Liberty and Light Attack/Armed Reconnaissance aircraft perform common roles and missions while integrating operations, in order to maximize their support to COIN operations? This study begins by detailing the operational requirements and historical events that led to the acquisition of the MC-12W Liberty aircraft. It also introduces the requirements for a Light Attack/Armed Reconnaissance aircraft. The study then examines major aircraft systems and subsystems in order to determine the each aircraft's combat capabilities. In order to highlight appropriate roles and missions for the two aircraft, the study juxtaposes the current MC-12W aircrew-training program with an example of a future Light Attack/Armed Reconnaissance aircraft aircrew-training syllabus. The study then examines crew manning ratios, aircraft production numbers, force development plans, and Air Expeditionary Force rotation schedules in order to determine the feasibility of adding additional mission sets to current and anticipated training requirements. Finally, the study draws conclusions and provides recommendations for future MC-12W and Light Attack/Armed Reconnaissance aircraft integration.

Although the MC-12W Liberty and the Light Attack/Armed Reconnaissance aircraft possess similar components and combat capabilities, the author argues that the two weapons systems are not interchangeable. Instead, individual aircraft designs, aircrew-training programs, and organizational constructs result in two unique weapon systems optimized for different roles and missions. Despite these limitations, the two aircraft should operate in multi-aircraft packages in order to shorten the kill chain while prosecuting commander designated, ground targets. In order to achieve this level of integration, the USAF will have to introduce integrated operations as an integral part of the MC-12W training program as well as make changes in the MC-12W Liberty's manning and deployment constructs.

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The MC-12W Requirement and Research Design

In an address to the United States Air Force's (USAF) Air University students and staff on April 21, 2008, Secretary of Defense Robert M. Gates criticized the Air Force for failing to adapt quickly enough to ever-evolving combat conditions in Iraq and Afghanistan. Secretary Gates asserted:

> In my view, we can do and we should do more to meet the needs of men and women fighting in the current conflicts while their outcome may still be in doubt. My concern is that our services are still not moving aggressively in wartime to provide resources needed now on the battlefield. I've been wrestling for months to get more intelligence, surveillance and reconnaissance assets (ISR) into the theater. Because people were stuck in old ways of doing business, it's been like pulling teeth. While we've doubled this capability in recent months, it is still not good enough. And so last week I established a Department of Defense-wide task force, much like the MRAP Task Force, to work this problem in the weeks to come, to find more innovative and bold ways to help those whose lives are on the line. The deadlines for the task force's work are very short.[1]

The deadlines were very short indeed. Responding to recommendations submitted by the Secretary's ISR Task Force, the Office of the Secretary of Defense ordered the Air Force to begin "procurement of 37 C-12 class aircraft to augment unmanned systems" including the MQ-1 Predator and MQ-9 Reaper unmanned aerial systems (UAS) already operating in the United States Central Command's (USCENTCOM) area of responsibility (AOR).[2] The ISR Task Force envisioned using augmented versions of the C-12 to provide additional real-time ISR capability to ground forces engaged in combat operations in Iraq and Afghanistan. The Air Force chose eight King Air 350s and twenty-nine King Air 350ERs from civilian sources and modified them with ISR and communications equipment in order to meet the ISR Task Force's requirements.[3] The

[1]Office of the Assistant Secretary of Defense, Public Affairs, *United States Department of Defense News*, April 21, 2008, http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=4214 (accessed October 9, 2009).

[2]Joint Base Balad, "MC-12W Liberty Project Aircraft (LPA)," June 2009, http://www.balad.afcent.af.mil/library/factsheets/factsheet.asp?id=14809 (accessed October 9, 2009).

[3]airforce-technology.com, "MC-12W Liberty ISR Aircraft, USA," June 2009, http://www.airforce-technology.com/projects/mc-liberty/ (accessed October 9, 2009).

Hawker Beechcraft Corporation from Wichita, Kansas received the contract to modify the thirty-seven King Air 350s. The USAF gave these augmented aircraft the designation MC-12W.[4] The USAF accepted delivery of the first MC-12W Liberty at Key Field in Meridian, Mississippi, on April 28, 2009.[5] This delivery occurred just a year and one week after Secretary Gates had publicly announced the formation of the ISR task force in his speech at Maxwell Air Force Base. Although the official aircrew-training syllabus still existed only in draft format at Air Combat Command (ACC) Headquarters, the USAF quickly produced a cadre of pilots and sensor operators using an interim training program. As a result of these efforts, the MC-12W flew its first combat sortie over Iraq on June 12, 2009.

Figure 1. MC-12W Preparing To Take Off During Operation Iraqi Freedom
Source: Joint Base Balad, "MC-12W Liberty Project Aircraft (LPA)," June 2009, http://www.balad.afcent.af.mil/library/factsheets/factsheet.asp?id=14809 (accessed October 9, 2009).

[4]The "M" prefix indicates the aircraft is a multirole version of the Department of Defense's C-12 series cargo aircraft.

[5]U.S. Air Force, Air Combat Command, "MC-12," August 2009, http://www.af.mil/information/factsheets/factsheet.asp?fsID=15202 (accessed October 10, 2009).

Although Secretary Gates' call for greater responsiveness from the Air Force and greater numbers of ISR assets served as a clarion call to top officials in the Department of the Air Force, it did not mark the beginning of studies directed at employing off-the-shelf, mission specialized aircraft for conducting counterinsurgency (COIN) operations. In addition to the MC-12W Liberty aircraft, the USAF had been studying a project designed to provide low cost air support to forces engaged in COIN operations since at least January 2007. The Air Force called this project the Observation/Attack-X (OA-X) or Light Attack/Armed Reconnaissance (LAAR) aircraft. Due to similar performance, electro-optical and infrared imagery collection hardware, and communication reach-back capabilities, both the MC-12W and LAAR aircraft are technically capable of performing ISR and Forward Air Controller-Airborne (FAC(A)) missions. Although there are no current plans for the aircraft to share these mission areas, the capability overlap has led to questions at ACC Headquarters concerning the appropriate roles and missions for each aircraft and their future integration in support of COIN operations. This study attempts to answer the question of whether the MC-12W Liberty and LAAR aircraft perform common roles and missions while integrating operations, in order to maximize their support to COIN operations.

This study utilizes government requests for information, contracting data, capabilities and need statements, service memoranda, contractor produced publications, flight manuals, training programs, and doctrinal publications to answer the question: Can the MC-12W Liberty and LAAR aircraft perform common roles and missions while integrating operations, in order to maximize their support to COIN operations? Although there are multiple entrants in the LAAR competition including the Embraer Super Tucano, Air Tractor AT 802U, Hawker-Beechcraft AT-6B, and a revamped version of Boeing's OV-10 Bronco, this study focuses on the Hawker Beechcraft's AT-6B as a representative model of the class of aircraft detailed in USAF capability requests. The study author selected the AT-6B because it is currently undergoing operational COIN testing with the ACC at several locations in the continental United States (CONUS). In

addition, multiple agencies have produced large amounts of publicly available data concerning the AT-6B airframe in preparation for the upcoming LAAR competition.

Figure 2. Artist's Conception of AT-6B In Flight
Source: Hawker Beechcraft, "Beechcraft AT-6B" (Briefing, Wichita: Hawker Beechcraft, 2008).

This study began by detailing the operational requirements and historical events that led to the acquisition of the MC-12W Liberty aircraft. It will also introduce the requirements for an LAAR aircraft. The study will then examine the major MC-12W and AT-6B aircraft systems and subsystems in order to determine the aircrafts' individual combat capabilities. In order to highlight appropriate roles and missions for the two aircraft, the study juxtaposes the current MC-

12W aircrew-training program with an example of a future LAAR aircrew-training syllabus. The study author chose the A-10C FAC(A) training syllabus as a representative example of future LAAR training programs because it encompasses all of the roles and missions anticipated for the LAAR aircraft. After a brief discussion detailing the MC-12W Liberty's current integration with other aircraft in the CENTCOM AOR, the study examines crew manning ratios, aircraft production numbers, force development plans, and Air Expeditionary Force (AEF) rotation schedules to determine the feasibility of adding mission sets to current and anticipated training requirements. Finally, the study draws conclusions and provides recommendations for future MC-12W and LAAR integration.

Although the MC-12W Liberty and the AT-6B possess similar components and combat capabilities, the author argues that the two weapons systems are not interchangeable. Instead, individual aircraft designs, aircrew-training programs, and organizational constructs result in two unique weapon systems optimized for different roles and missions. The USAF has optimized the MC-12W program for tactical ISR operations, and it will be difficult for the Liberty's aircrews to effectively perform roles and missions beyond ISR. Similarly, although the LAAR aircraft can perform ISR missions, it is far better suited for its intended ground-attack role. Despite these limitations, the two aircraft should operate in multi-aircraft packages in order to shorten the kill chain while prosecuting commander designated, ground targets.[6] Packaged integration will enable the Joint Force Commander to leverage both platforms' synergistic ISR and command and control (C2) capabilities in order to gain multi-domain situational awareness of multiple targets while utilizing the lethal effects provided by the LAAR aircraft. In order to achieve this level of integration, the USAF will have to introduce integrated operations as an integral part of the MC-

[6]The kill chain is the sequence of events that must occur for an aircraft or other combat asset to successfully detect, identify, target, track, engage, and kill an intended target.

12W training program as well as make changes in the MC-12W Liberty's manning and deployment constructs.

The LAAR Requirement

Ever since the A-10 Thunderbolt II made its debut as the Air Force's primary close air support platform, the idea of using propeller driven mission specialized aircraft in combat operations slowly faded from mainstream airpower advocates' consciousness. This occurred despite the fact that propeller-driven aircraft performed ground attack and observation missions in every war the United States participated in before the late 1990s. However, after September 11, 2001, steady demand for propeller driven unmanned aerial vehicles (UAV) sparked a desire for similar low cost combat solutions. As UAV platforms assumed larger portions of the close air support (CAS) mission in both Operation Iraqi freedom (OIF) and Operation Enduring Freedom (OEF), the idea of using manned propeller driven aircraft in the CAS role made a dramatic resurgence. The requirement for a manned, propeller-driven, CAS aircraft gave birth to the LAAR concept.

The LAAR aircraft continued to receive increasing support in Air Force circles due to the growing risks associated with the service's continued reliance on legacy-fighter aircraft to perform counterinsurgency operations. These risks included significantly reduced airframe life, reduced flight crew proficiency in primary declared operational capabilities (DOC), and ballooning support costs.[7] In order to offset these risks, in July 2009, the USAF issued a Capability Request for Information (CRFI) for an aircraft that:

> Will integrate with traditional Command and Control (C2) concepts and organizations and existing joint Tactics, Techniques and Procedures (TTPs). Mission planning will require access to theater air tasking order (ATO) and airspace control order (ACO) dissemination networks. LAAR may be tasked as part of a joint team and will require communication capabilities to coordinate with supported and/or supporting units. LAAR platforms will employ a modular structure capable of interfacing with multiple weapons

[7]Steven J. Tittel, "Cost, Capability, and the Hunt for a Lightweight Ground Attack Aircraft" (Master's Thesis, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 2009), 14.

> and sensors to tailor configuration to tasking and have robust, integrated sensors used to find, fix, track, and target within a single asset. For LAAR platforms, aerial gunnery and precision weapons will provide the ability to engage targets quickly, thus reducing the sensor-to-shooter timeline. LAAR platforms will have the ability to coordinate fires directly with supported ground units through voice, video, and data links with other assets to create synergies and minimize fratricide.[8]

This CRFI was very similar to one the USAF had issued two years earlier. In May 2007, the 337th Aeronautical Systems Group at Wright-Patterson AFB submitted a CRFI detailing the requirements for a COIN aircraft for the Iraqi Air Force (IqAF).[9] The USAF eventually dropped this request when a burgeoning petroleum-based economy made high performance jet fighters a more lucrative possibility for the Iraqis. However, the LAAR concept continued to gain momentum.

Three recent master's theses written by USAF officers examined fielding a lightweight, ground-attack aircraft. These included Major Arthur D. Davis' thesis from April 2005 entitled "Back to the Basics: An Aviation Solution to Counter Insurgent Warfare". In his thesis, Major Davis focused on historical cases where Air Forces used propeller driven aircraft in counterinsurgencies.[10] Major Davis advocated procuring a variant of the T-6A Texan II for use in the COIN role. Davis' recommendations corresponded closely with those found in a graduate thesis written in 2007 by Major Brett R. Blake entitled "AT-6: The Best USAF Investment for the Long War."[11] Major Blake's paper concentrated on the fiscal benefits associated with using the AT-6 to replace legacy fighter platforms in Iraq and Afghanistan. Major David L. Peeler's 2008

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[8]Elizabeth Eberhart, Capability Request for Information Air Combat Command (ACC) Light Attack/Armed Reconnaissance (LAAR), Wright Patterson Air Force Base, U.S. Air Force Materiel Command, 2009.

[9]Lt Col. J. David Torres-Laboy, "A New Light Attack Aircraft: Making the Case for the Current Fight and Preparing for Future Conflicts" (Draft White Paper, Langley Air Force Base, VA, 2008), 2.

[10]Arthur D. Davis, "Back to the Basics: An Aviation Solution to Counter-Insurgent Warfare" (Master's Thesis, Air Command and Staff College, Maxwell AFB, AL, 2005), 15.

[11]Brett R. Blake, "AT-6 The Best US Investment for the Long War" (Master's Thesis, Air University, Maxwell Air Force Base, AL, 2007).

thesis, entitled "A Method and Estimate for Counterinsurgency Aircraft Procurement" supplemented Major Blake's research. Peeler's thesis detailed a process to procure counterinsurgency aircraft. The paper specifically focused on the U.S. Special Operations Command's acquisition authority "to couple its Global War on Terror (GWOT) mission responsibility with commercial-off-the-shelf aircraft procurement to specifically address the need for an airborne COIN capability."[12] All three papers recommended purchasing an LAAR platform for future COIN operations. In addition, all three authors recommended purchasing a variant of the AT-6 despite Hawker-Beechcraft having not yet produced an aircraft that could meet anticipated Air Force specifications.

In June 2009, this study's author also published a master's thesis entitled "Cost, Capability, and the Hunt for a Lightweight Ground Attack Aircraft" examining the costs and benefits of fielding a propeller driven lightweight, ground-attack aircraft to support COIN operations.[13] The study used a document review to determine the expected economic impacts, combat capabilities, survivability issues, and potential roles and missions associated with fielding a lightweight, ground-attack aircraft. The author argued that fielding a lightweight, ground-attack aircraft could enable the USAF to redeploy the bulk of its legacy-fighter fleet to bases in the CONUS in order to slow the adverse effects of the current operations tempo.

Staff officers in the Air Combat Command's Joint Air Ground Combat Division (A3F) also authored several papers outlining LAAR concept details. They highlighted the inefficiencies and expense of using a legacy-fighter force developed for major combat operations to support COIN missions. The ACC staff also emphasized the unacceptability of sacrificing readiness in conventional mission areas and recommended that the USAF procure of a new, single-mission,

[12]Maj. David L. Peeler Jr., "A Method & Estimate for Counterinsurgency Aircraft Procurement," *Small Wars Journal* (February 2008): 5.

[13]Tittel, iv.

light attack-aircraft to complement the existing fleet and perform the COIN mission.[14] The United States Air Force Headquarters shared the Air Combat Command's concerns. In a briefing entitled "Air Force Lessons Learned Issue Review (L2IR) March 2008," Headquarters United States Air Force argued that strike aircraft, including the Air Force's A-10, F-15E and F-16, are "overqualified" for the majority of the missions they perform in Southwest Asia.[15] They also argued that a light attack aircraft similar the AT-6 could perform the preponderance of COIN missions.[16]

ACC soon developed specifications outlining the desired performance characteristics and combat capabilities of the anticipated LAAR aircraft as well as its intended roles and missions. The ACC specifications called for a Commercial-Off-The Shelf aircraft modified to perform COIN operations. The authors desired a lightly armored, two-seat, turbo-prop aircraft with a suite of electro-optical and infrared (EO/IR) sensors, laser-guided and unguided air-to-ground munitions, and advanced data sharing capabilities. They also specified that the aircraft possess a robust threat-detection and countermeasure suite as well as the capability to perform as an advanced fixed-wing, flight trainer aircraft. The staff included a host of specific requirements dealing with austere field capabilities, combat range, loiter time, weapons payloads, ejection seats, NVG compatible cockpits, and IFR avionics.[17] This led to the Air Force's 2009 CRFI. By the time the USAF issued its request, several aircraft manufacturers including Hawker-Beechcraft, Embraer, and Air Tractor had already begun developing aircraft to meet the USAF

[14]Ibid., 4.

[15]Headquarters, U.S. Air Force, "Air Force Lessons Learned Issue Review (L2IR)" (Briefing, March 2008).

[16]Ibid.

[17]Ibid., 2.

requirements in anticipation of an LAAR competition. Hawker-Beechcraft's entrant, an advanced version of its earlier AT-6 model, was designated the AT-6B.

AT-6B Systems

The AT-6B is an armed variant of the U.S. Air Force's T-6A Texan II primary trainer. It is a single engine, propeller driven, two-seat, low-wing monoplane with a 33.4-foot wingspan.[18] A 1,600 horsepower Pratt & Whitney Canada PT6A-68/10 turboprop engine powers the AT-6AB to speeds exceeding 320 nautical miles per hour.[19] The aircraft can climb to altitudes in excess of 30,000 feet mean sea level and cruise up to 900 nautical miles.[20] The AT-6B's tandem seating and bubble canopy provides its two-man crew with excellent visibility. Although the AT-6B lacks the raw power and speed advantages prevalent among current jet-powered fighter aircraft, its slower operating speed and fuel efficiency gives it an excellent combat radius. In addition, the AT-6B retains enough performance capability to enable reasonable response times to emergency situations.

Avionics and Communications

The AT-6B avionics system controls weapons delivery and other related functions using two, modular, mission-computers. A large, twenty-five-degree Head-Up Display (HUD) and three, high fidelity, color, five-by-seven inch multifunction displays (MFD) aid pilot-vehicle interface.[21] The AT-6B can be equipped with a helmet mounted cueing system and Hands on Throttle and Stick (HOTAS) functionality similar to that found in legacy-fighter aircraft including

[18]U.S. Air Force, Air Education and Training Command, "T-6A Texan II," October 2005, http://www.af.mil/information/factsheets/factsheet.asp?fsID=124 (accessed November 16, 2009).

[19]Ibid.

[20]Ibid.

[21]Excalibur Research & Development, LLC, "AT-6 Questions For a Spokesperson For Hawker-Beechcraft," June 21, 2007, http://www.excaliburd.com/docs/AT-6Project/AT-6HawkerBeechcraft.pdf (accessed December 15, 2008).

the F-16 and F-15.[22] AT-6B displays and interior cockpit components are also compatible for use with night vision goggles (NVG). Hawker-Beechcraft offers a variety of communication components including ultra-high frequency (UHF), very-high frequency (VHF), and satellite communications (SATCOM) radios, the Enhanced Position Location and Reporting System (EPLARS), the Joint Tactical Information Distribution System (JTIDS), a Situational Awareness Data Link (SADL), and the LINK-16 data link in the AT-6B design. These systems give the aircraft the capability to integrate with multiple Joint Force command and control nodes while simultaneously sharing data with the Combined Air Operations Center's (CAOC) Intelligence, Surveillance, and Reconnaissance Division (ISRD).[23] The AT-6B also carries the same Wescam MX-15Di electro-optical and infrared targeting sensor carried on the MC-12W.[24] The MX-15Di hardware includes day and night electro-optical sensors, infrared sensors, a laser illuminator, a laser rangefinder, and a laser designator.

[22]HOTAS is a style of aircraft control that allows pilots to access cockpit functions and fly the aircraft without removing their hands from the throttle or control stick.

[23]Excalibur Research & Development.

[24]Ibid.

Figure 3. MX-15 Di Sensor Ball
Source: L3 Communications Wescam, "The Wescam MX-15Di," February 2009, http://www.wescam.com/products/products_services_1f_mx15.asp (accessed November 17, 2009).

In permissive air environments, these systems will enable AT-6B pilots to assume responsibility for ground-attack missions currently flown by legacy-fighter aircraft. In addition, the AT-6B's robust communications suite and EO/IR surveillance capabilities will enable it to augment the MC-12W Liberty, MQ-1 Predator, and MQ-9 Reaper in the ISR role.[25] The AT-6B's communication suite will also enable pilots to integrate fire-support and surveillance assets with Joint Terminal Air Controllers (JTAC), engaged ground forces, and headquarters units requiring information in near real time. A robust weapons delivery capability also augments the AT-6B's avionics, communications, and sensor suites.

[25]This includes ISR missions in the EO/IR spectrum only. The AT-6B lacks the ability to perfom SIGINT operations.

Figure 4. AT-6B Cockpit

Source: The Hawker Beechcraft Corporation, "Multiple Challenges, Multiple Missions, One Solution," June 2009, http://www.hawkerbeechcraft.com/military/at-6_ab/R0816AT-6_LithoUpdate.pdf (accessed November 16, 2009).

Weapons and Defensive Systems

The AT-6B sports a light, but versatile, weapons payload. The aircraft is equipped with six wing-mounted hard points for carrying external stores. A MIL-STD 1760 smart weapons interface gives the AT-6B the capability to carry a variety of guided and unguided munitions.[26] The AT-6B's munitions inventory includes fifty-caliber and twenty-millimeter machineguns, air-

[26]The MIL-STD-1760 connecter is used to transfer guidance and targeting information from the aircraft's mission computer to its externally mounted weapons which may include both Laser and GPS guided munitions.

to-air and air-to-ground missiles, laser and Global Positioning System (GPS) guided bombs, unguided air-to-surface munitions, and rockets.[27] Hawker-Beechcraft asserts:

> For the AT-6B, we are incorporating precision guided munitions to include using 250 and 500 pound laser guided bombs, laser guided rockets, and AGM-114 Hellfire missiles. The aircraft is capable of carrying almost 3,000 pounds but the load out for most missions would be in the 1,500 to 2,000 pound range.[28]

The FN Herstal Corporation in Herstal, Belgium manufactures the AT-6B's HMP 400 external gun pod. The HMP 400 contains a fifty-caliber M3P single-barrel machinegun and 400 rounds of ammunition. The M3P's rate of fire is adjustable, but is generally set at 1,000 rounds per minute.[29] The HMP 400 gun pod is also capable of simultaneously carrying 2.75-inch rockets and machinegun ammunition. In addition, Hawker Beechcraft claims it can mount a twenty-millimeter cannon on the AT-6B although there is no information available on either magazine capacity or the weapon's rate of fire.[30] Except for the A-10C, which carries a 30-millimeter cannon, the 20mm weapon is the same caliber as those carried by most legacy-fighter aircraft. Unfortunately, unlike current legacy-fighter aircraft, the AT-6B's gun pod occupies an external hard point and consumes a significant portion of the aircraft's available payload capacity. Despite this limitation, the AT-6B's payload remains well suited for operations in the COIN environment. The aircraft's mix of precision and non-precision munitions provides a cost effective means of prosecuting targets commonly found in the COIN environment. The AT-6B also retains enough

[27]Airforce technology.com, "AT-6B Light Attack Aircraft/Trainer, USA," January 2009, http://www.airforce-technology.com/projects/at-6b-light-attack/ (accessed February 11, 2009).

[28]Excalibur Research & Development.

[29]FN Herstal, "HMP 400 LCC," February 16, 2009, http:fnhertal.com/index.php?id=314&backPID=311&productID=37&pid_product=302&pidList=311&categorySelector=19&detail= (accessed March 21, 2009).

[30]The Hawker Beechcraft Corporation, "Multiple Challenges, Multiple Missions, One Solution," June 2009, http://www.hawkerbeechcraft.com/military/at-6_ab/R0816AT-6_LithoUpdate.pdf (accessed November 16, 2009).

payload capacity to effectively respond to situations requiring high explosive munitions in excess of 500 pounds.

Although the AT-6B can operate at altitudes exceeding 30,000 feet mean sea level in a clean configuration, the aircraft's practical operating altitude drops quickly when it carries external stores. The AT-6B will typically operate from 15,000 to 20,000 feet Mean Sea Level when carrying a combat load.[31] These operating altitudes will keep the aircraft clear of most small arms and small-caliber anti-aircraft artillery systems. However, the aircraft will remain susceptible to man portable air defense systems (MANPADS), medium and heavy-caliber anti-aircraft artillery, and radar guided surface-to-air missiles. Elevated terrain similar to the mountains found in Afghanistan will only increase the lethality of these threats. In addition to several self-defense systems designed to protect the aircraft from infrared surface-to-air missiles, the AT-6B utilizes ceramic armor plates covering the cockpit and engine area to increase its survivability.[32] The ALE-47 countermeasure dispenser and the AN/AAR-47 missile approach warning system provide passive detection, warning, and deception capabilities to counter infrared and laser-guided missiles.[33] Unfortunately, Hawker Beechcraft has not equipped the AT-6B with a radar-warning receiver. In addition, there are no current plans to install an electronic countermeasures pod on the aircraft. This means aircrews have no on-board countermeasures to detect or defeat radar guided surface-to-air missiles and anti-aircraft artillery. Because of the AT-6B's limited self-protection suite and lower operating altitudes, the aircraft is best suited for operations in permissive airspace where friendly forces can maintain air superiority and suppress radar guided anti-aircraft weapon systems.

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[31]Hawker Beechcraft, "Beechcraft AT-6B" (Briefing, Wichita, KS, 2008).

[32]Ibid.

[33]Ibid.

MC-12W Systems

As previously mentioned, the MC-12W Liberty is a militarized variant of the Beechcraft 350 and 350ER civilian aircraft. The USAF contracted Hawker-Beechcraft Corporation of Wichita, Kansas, to convert these off-the-shelf civilian general-aviation aircraft into ISR platforms. A pair of Pratt and Whitney PT6A-60A engines powers the 12,500-pound aircraft enabling it to reach airspeeds over 300 nautical miles per hour and climb to altitudes exceeding 35,000 feet mean sea level.[34] With its crew of four, the MC-12W can sustain combat operations for up to five hours without landing and refueling.[35]

The MC-12W weapon system includes the aircraft, aircrew, ground stations, analysts, and dissemination equipment. The MC-12W aircraft is designed to accomplish medium to low-altitude ISR missions in direct support of ground forces engaged in COIN operations. The USAF equipped the MC-12W with multiple sensor and communication packages in order to enhance its utility. The two-place crew compartment located in the aircraft's aft cabin contains most of the sensitive ISR equipment. The EO/IR sensor ball operator (SBO) occupies the aft cabin's forward station while the tactical sensor operator (TSO) operates the signal intelligence (SIGINT) equipment from the rear station. Both consoles face forward and each operator's equipment bay contains two modular racks housing the specialized equipment utilized by the aircraft while performing its mission.[36]

The pilot and copilot sit side by side in the aircraft's forward crew compartment. Hawker-Beechcraft replaced the aircraft's original Beechcraft avionics suites with a Rockwell

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[34]U.S. Air Force, Air Combat Command, "MC-12," August 2009, http://www.af.mil/information/factsheets/factsheet.asp?fsID=15202 (accessed October 10, 2009).

[35]Christie League, "Project Liberty Update (Topic 1)" (Langley AFB: Headquarters Air Combat Command, January 27, 2009).

[36]Ibid., 21.

Collins Pro Line 21 Integrated Display System avionics package.[37] This system is a commonly used, aftermarket upgrade to the original aircraft avionics hardware and software. The Pro Line 21 has seen extensive use in civil aviation circles and has earned an excellent reputation for safety and reliability.[38] Rockwell Collins designed the Pro Line 21 system to help aircrews quickly assimilate large amounts of data.[39] Large, flat-panel, liquid crystal displays (LCD) similar to those found on the AT-6B, provide aircrews with navigation, engine performance, and sensor data. Aircrews can use the system to access airport approach-plates, electronic checklists, and digital airport maps displaying the aircraft's real-time position.[40] The system also has the capability to access remote file servers using a wide-band ethernet connection for efficient data passage.[41] In areas where it is available, the ethernet connection gives aircrews the option of accessing real-time weather and terrain data via the Broadcast Graphical Weather system.[42] The forward cabin displays are NVG compatible and enable aircrews to operate the aircraft at night and in low illumination using visual references supplemented by the aircraft's avionics.[43] However, various aircraft structures including window posts, wings, engine nacelles, and the cabin-roof limit aircrew visibility. These obstructions make it difficult for the pilots and sensor operators to gain and maintain visual contact with friendly and enemy forces on the ground.

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[37]Ibid., 18.

[38]Rockwell Collins, *Pro Line 21 Integrated Display System: Advance your Flight Deck by Simplifying It* (Cedar Rapids, IA: Rockwell Collins, May 1, 2007), 2.

[39]Rockwell Collins, *Integrated Flight Information System: Flight Information That Keeps Pilots a Step Ahead* (Cedar Rapids, IA: Rockwell Collins, January 2007), 2.

[40]Ibid.

[41]Ibid.

[42]Ibid., 1.

[43]Headquarters Air Combat Command, "Project Liberty Update (Topic 1)" (Briefing, Langley Air Force Base, 2009), 6.

Figure 5. MC-12W Pro Line 21 Cockpit Configuration
Source: Headquarters Air Combat Command, "Project Liberty Update (Topic 1)" (Briefing, Langley Air Force Base: Headquarters Air Combat Command, 2009), 30.

EO/IR Systems

The MX-15Di sensor carried by the AT-6B is also the heart of the MC-12W's imagery intelligence collection capability. The MX-15 Di's modular design enables it to support up to six high-performance sensors including a color daylight camera with a zoom lens, a monochrome daylight camera with a narrow field-of-view lens, and an infrared camera with four incremental fields of view.[44] Images captured on the MX-15Di can be collected and passed on to ground analysts via the MC-12W's robust communications and data link architecture.

[44]L3 Communications Wescam, "The Wescam MX-15Di," February 2009, http://www.wescam.com/products/products_services_1f_mx15.asp (accessed November 17, 2009).

The MX-15Di's laser target designator, laser illuminator, and laser spot tracker also provide the MC-12W with a robust target tracking, designation, and munitions guidance capability. The MX-15Di can automatically track targets in a "hands-off" mode while simultaneously calculating their precise latitude and longitude.[45] Aircrew can use the EO/IR sensor's laser designator to steer laser-guided munitions dropped from other aircraft onto a designated target.[46] The SBO can also use the laser illuminator to covertly designate targets for both airborne and ground forces.[47] In addition, the SBO can quickly identify laser designations provided by external ground and airborne sources using the sensor's laser spot tracker.[48] Although the EO/IR sensor ball operator's display is located in the aft cabin, the pilot and copilot can monitor MX-15Di operations on a computer screen located in the forward cabin in order to augment their visual situation awareness. However, the EO/IR sensor ball operator is the only crewmember that can directly control the MX-15Di. Ironically, the sensor ball operator's visual field of view from the aft cabin is extremely poor. This is because Hawker-Beechcraft covered all but two of the King Air 350's original aft cabin windows in order to protect the sensitive equipment in the rear compartment from direct sunlight and potential foreign intelligence exploitation.

Signals Intelligence (SIGINT) Systems

The MC-12W possesses a robust SIGINT capability that enables it to rapidly disseminate critical information supporting the joint force commander's efforts in the COIN environment. The TSO occupying the rear position of the aircraft's aft cabin operates the SIGINT gear. The TSO

[45]Ibid.

[46]Ibid.

[47]Ibid.

[48]Ibid.

can link the aircraft's SIGINT system to the U.S. Air Force's Distributed Common Ground System (DCGS) in order to transmit critical data in real-time. The DCGS is a ground processing system that supports a range of ISR collection and information gathering systems.[49] The MC-12W's EO/IR and SIGINT systems are on par with, or superior to, those carried by tactical unmanned aerial platforms currently operating in the CENTCOM AOR. The MC-12W also has the ability to operate from small, austere operating locations making it the most flexible tactical reconnaissance platform currently in operation. Finally, because the AT-6B does not carry SIGINT gear, the MC-12W is the better choice for performing tactical ISR missions that require SIGINT capabilities.

Communications Systems

Although the MC-12W can store collected intelligence on-board the aircraft for later download and exploitation, an advanced communications suite enables the aircrew to transmit valuable intelligence to multiple command echelons across the AOR in real time. The communications suite consists of multiple Raytheon AN/ARC 231 and Harris PRC-117G radio sets. The ARC-231 Radio System uses a frequency hopping capability operating in both AM/FM line-of-sight (LOS) and satellite communications (SATCOM) modes to avoid enemy attempts at jamming communications.[50] The SATCOM modes also give the MC-12W a beyond line-of-sight (BLOS) satellite communications capability. The radio can also interact with various communications network architectures using an embedded internet protocol (IP) stack with menu-configurable network parameters.[51] In addition, technicians can upgrade the ARC-231

[49]Global Security.org, "Distributed Common ground Information System," November 15, 2005, http://www.globalsecurity.org/intell/systems/dcgs.htm (accessed December 10, 2009).

[50]Raytheon, "AN/ARC-231 Airborne Communications System," January 15, 2008, http://www.raytheon.com/capabilities/products/arc231/ (accessed November 17, 2009), 1.

[51]Ibid.

using PC-based software downloads without removing the equipment from the aircraft.[52] This system is the heart of the MC-12W's multi-band, secure, anti-jam, voice, data, imagery, and network-capable communications architecture.

The AN/PRC-117G is the same wideband tactical radio currently carried by ground forces deployed in the CENTCOM AOR.[53] The AN/PRC-117G is capable of simultaneously transmitting voice, video, situational awareness, and intelligence data to other agents participating in various battlefield data networks.[54] The AN/PRC-117G operates in many of the same modes as the ARC-213 but adds a Remote Operations Video Enhanced Receiver (ROVER) capability as well.[55] ROVER receives and displays data from airborne targeting pods and tactical UAV platforms. ROVER is particularly useful when exchanging imagery and video data with engaged ground forces.

One of the MC-12W Liberty communications suite's most important attributes is its ability to transmit intelligence data in near real time to the Air Force's Processing Exploitation and Dissemination (PED) Management System. The PED cell is a component of the USAF Intelligence, Surveillance, and Reconnaissance Division (ISRD) located in the CAOC. It is comprised of three groups that include Tasking Exploitation Management (TEM) team, the Imagery Support Element (ISE), and the ISR Assessment (ISR-A) team. These three teams provide exploitation guidance, special products and qualitative assessments for supported commanders.[56] The TEM team manages high-demand, low-density exploitation resources to

[52]Ibid.

[53]Harris RF Communications, AN/PRC-117G(V)1(C) Type-1 Wideband Multiband Multimission Radio with Internal SAASM GPS (Product Brochure, 2009), 1.

[54]Ibid.

[55]Ibid.

[56]Ibid.

efficiently disseminate imagery products to requesting customers across the globe.[57] The ISE provides basic targeting graphics to the Targets Cell also located in the CAOC.[58] ISE target materials are the starting point for target nominations and help feed the time-sensitive targeting process. After the ISE provides the basic details concerning a prospective target, the Targets Cell builds upon that information as the targeting process continues. ISE imagery analysts provide imagery products using intelligence gained from national satellite, U-2, GLOBAL HAWK, PREDATOR, commercial imagery, and MC-12W sources.[59] These products provide commanders with a near-real time, comprehensive view of targets effecting their operations across the AOR. Finally, the ISR-A team evaluates the Intelligence Surveillance, and Reconnaissance Division's planning and operational execution.[60] ISR-A makes quantitative and qualitative assessments of originating from ISR missions assessments and then recommends procedural or operational improvements designed to improve mission effectiveness.[61]

The MC-12W weapon system ties its sensor data into both the existing ISRD and PED architecture while simultaneously pushing data directly to intelligence consumers at lower echelons. The USAF can place MC-12W PED cells at echelons as low as the Brigade Combat Team Tactical Operations Center (TOC). This capability enables the system to provide direct support to unit commanders at the tactical level.[62] Here, tactical commanders receive access to ROVER, data link, and SATCOM capabilities. In order to accomplish this, the MC-12W's ISR collection and distribution system leverages existing commercial communications links and

[57]Ibid.

[58]Ibid.

[59]Ibid.

[60]Ibid.

[61]Ibid.

[62]Ibid.

USAF communications architectures to import MC-12W, and in the future, possibly LAAR aircraft data.[63] Commanders can use the system to share intelligence data with partner-nations at the unclassified level as long as system remains disconnected from the U.S. national intelligence collection architecture.[64] The system can still integrate with selected elements of the USAF ISR infrastructure even while operating in the unclassified mode.[65] This capability provides the MC-12W with a niche role in building partnership capacity. Building partnership capacity is key enabler in COIN operations that facilitate, train, and equip, partner-nations in order to prepare them for autonomous operations.

Aircrew Training

The technical data demonstrates the MC-12W and LAAR aircraft's potential to successfully perform various roles and missions included in COIN operations. However, in addition to aircraft systems and sub-systems, aircrew-training regimens play an integral role in determining a weapons system's overall utility in the contemporary operating environment. A detailed review of the MC-12W and LAAR training programs will shed light on the roles and missions suitable for these aircraft.

COIN operations encompass several different mission sets including CAS, Aerial Interdiction (AI), FAC(A), and air mobility. In the on-going operations in Iraq and Afghanistan, CAS and FAC(A) are the two most commonly conducted lethal, counter-land missions. According to USAF Doctrine Document 2-1.3, *Counter Land Operations*, CAS is:

[63]Headquarters Air Combat Command, "Project Liberty Update (Topic 1)" (Briefing, Langley Air Force Base, 2009), 30.

[64]Ibid.

[65]Ibid.

> Air action by fixed- and rotary-winged aircraft against hostile targets that are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces.[66]

The FAC(A) mission enables increased CAS efficiency and effectiveness. FAC(A) qualified aircrews provide joint, terminal-attack control (JTAC) for CAS aircraft and other fires support assets operating in close proximity to friendly ground forces.[67] Due to the risk of fratricide, joint force commanders require FAC(A) qualified aircrew to receive extensive training before they are authorized to provide weapons release clearance to CAS aircraft.

ISR, Special Operations Forces (SOF), and Information Operations (IO) compliment lethal counter land efforts including COIN operations. ISR missions provide persistent, accurate, and timely intelligence to help commanders anticipate environmental factors, predict enemy actions, identify targets, and develop combat assessments.[68] SOF forces provide intelligence, target cueing, terminal attack control, guidance for precision-guided munitions (PGMs), and post attack assessment to both air and ground forces.[69] IO operations target enemy information systems and can have collateral effects on the entire enemy system through the disruption, degradation, denial, and destruction of its C2 networks.[70]

MC-12W Training

The MC-12W Liberty training syllabus is currently in draft format and under revision at the USAF ACC Headquarters. In the absence of an officially mandated ACC training program, MC-12W aircrews have been training for and deploying to combat operations in the

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[66]Headquarters Air Force Doctrine Center, Air Force Doctrine Document 2-1.3, *Counterland Operations* (Maxwell Air Force Base: Government Printing Office, 2006), 6.

[67]Ibid., 8.

[68]Ibid.

[69]Ibid., 13.

[70]Ibid.

USCENTCOM AOR using a set of interim training scenarios. The ACC formal training syllabus is a specialized publication that prescribes the overall training strategy and approximate amount of instruction required for a student with the entry prerequisites to graduate as a qualified MC-12W Liberty aircrew member.[71] Units tasked to implement the syllabus can adjust the amount and level of training devoted to mission elements, events, subjects, or phases as required to meet individual student needs. As written, the ACC draft syllabus simply formalizes the interim training scenarios that are already in place.

In the absence of a formalized training syllabus, MC-12W aircrews prepare for combat using the training scenarios administered by the Mississippi Air National Guard's 186th Air Refueling Wing (ARW) based at Key Field outside Meridian, Mississippi. In order to provide realistic combat training, instructors groom their students using a stair-step approach that begins by introducing them to basic ISR skills and then progressively advances into scenario-based missions that teach students tactics, techniques, and procedures for employing the MC-12W weapon system.[72] The 186th ARW revised these scenarios as recently as August 2009 in order to capture lessons learned during combat operations in the USCENTCOM AOR.

Students graduate from MC-12W aircrew training after completing a twelve-flight, mission qualification, upgrade program. The first five flights teach basic aircrew skill sets.[73] During these introductory flights, pilots, and sensor operators learn how to perform basic day and night tactical arrivals and departures, collect imagery and atmospheric signals, prosecute dynamic targets, analyze infrared imagery, report Essential Elements of Information (EEI), and perfect

[71]Headquarters Air Combat Command, Syllabus, *USAF Operations Training MC-12W Mission Qualification Training Course* (Langley Air Force Base: Government Printing Office,, 2009), 1.

[72]Craig Ziemba, Syllabus, *Project Liberty MQT Scenarios* (Meridian: Mississippi Air National Guard, 2009), 1.

[73]Ibid.

their NVG skills.[74] Flight instructors demonstrate the required skills before the students are allowed to begin practicing them. The instructors begin by demonstrating proper radio and system setup procedures as well as static surveillance and effective communication techniques. They also introduce Kill Box and Keypad airspace management during the first few flights.[75] These skills are essential for effective target coordination between the aircrews, JTACs, and personnel manning the PED cells in the TOC.

During their first night familiarization flight, students also learn techniques that enable them to use the covert laser designator to illuminate ground targets and guide convoys.[76] This flight also introduces multiple techniques for using the aircraft's infrared sensors to maintain situational awareness during convoy over-watch missions. Instructors also familiarize sensor operators with the basic skills required to verbally guide other airborne and ground assets to an observed target. However, the sensor operators do not receive any terminal-attack control training. This phase ends with an introduction to dynamic target surveillance (vehicle intercept) missions in both rural and urban environments.[77]

In sorties six through eight, aircrews begin utilizing Crew Resource Management (CRM) principles during their flight operations in order to maximize aircrew efficiency and safety while integrating the MC-12W's sensor suite into the AOR surveillance exploitation architecture.[78] This integration entails passing information to various user-level intelligence cells including the MC-12W's own ISR PED. Sortie number six is the first integrated flight in which the aircrew interacts

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[74]Ibid.

[75]Killboxes and Keypads are geographic coordination measures designed divide and AOR into managable portions in order to ease the coordination and integration of lethal and non-lethal fires.

[76]Craig Ziemba, Syllabus, *Project Liberty MQT Scenarios* (Meridian: Mississippi Air National Guard, 2009), 1.

[77]Ibid., 3.

[78]Ibid., 1.

with unit intelligence assets, the ISR PED, the TOC, and Ground Assault Force (GAF) personnel.[79] Aircrews begin this mission by conducting initial surveillance of a reported High Value Target (HVT) traveling in a motor vehicle. The simulated TOC directs the MC-12W aircrew to track the target vehicle until it reaches its final destination.[80] During this portion of the surveillance mission, the aircrew collects valuable imagery used to produce a series of graphics used in ground-assault force (GAF) operations.[81] Instructors also introduce the students to the tactics, techniques, and procedures used to develop infiltration and exfiltration plans.

Sorties seven and eight comprise a combined day-night, two-sortie mission that builds on the scenario begun during sortie number six. During this mission, the aircrews return to the original HVT destination area. Here, they monitor the personnel and vehicles entering and exiting the area until the TOC directs them to pass their ISR responsibilities to other surveillance assets and proceed to an unfamiliar Forward Area Refueling Point (FARP).[82] Aircrews practice using forward refueling points between sorties in order to simulate actual combat conditions. At the FARP, the students execute the appropriate aircraft refueling and servicing procedures before taking off for sortie number eight and returning to the HVT bed down location. During sortie eight, the students learn the techniques required to operate inside of a Restricted Operating Zone (ROZ) while de-conflicting from other airborne platforms supporting the ground force commander.[83] This sortie further refines the students' techniques for de-conflicting ground targeting responsibilities when performing over-watch missions in conjunction with other airborne assets. However, the students learn neither how to command the activities of a multi-

[79]Ibid., 3.

[80]Ibid., 3.

[81]Ibid., 4.

[82]Ibid.

[83]Ibid.

aircraft package, nor how to guide weapons from other aircraft onto designated ground targets. The mission ends when a supporting asset neutralizes the simulated HVT and ground forces take control of the bed down area.[84]

Sorties nine through eleven are complex missions that require students to integrate their skills and utilize them in simulated combat scenarios. The tactical portions of the combat scenarios are comprised of various mission elements including convoy over-watch, improvised explosive device (IED) attacks, ROZ procedures, target coordination, and personnel recovery.[85] Aircrews fly two of these missions back-to-back practicing day and night operations as well as an unplanned FARP refueling. Sortie number nine is the first flight in the two-sortie mission scenario. In sortie nine, students provide over-watch for Army convoys en-route to an area littered with potential improvised explosive devices.[86] Using the laser designator, students warn the convoy of potential danger and direct it along a safe route of travel without the benefit of audio communications. Sorties ten and eleven reinforce the skills students have learned to this point. If flight instructors believe a student aircrew is properly prepared, they may bypass sortie number eleven and advance the students to their final flight.

The course authors designed sortie twelve, the final flight in the program, to evaluate the students' situational awareness, CRM, and understanding of the basic skills required for operations in the USCENTCOM AOR. The sortie includes mission planning, briefing, tactical departure and arrival, imagery collection, and dynamic targeting.[87] After successfully completing this sortie, aircrews are qualified to execute operations in the COIN environment.

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[84]Ibid.

[85]Ibid., 5.

[86]Ibid.

[87]Ibid.

ACC planners specifically designed MC-12W training to produce highly specialized aircrews competent in performing ISR missions. Although many of the skills taught in this program are common to the FAC(A) mission, the training program currently places no emphasis on using these basic skills outside of the ISR role. The current syllabus does an excellent job of training aircrew to operate the aircraft sensors and pass the collected intelligence data to multiple echelons including ground forces engaged in combat operations. However, the syllabus fails to teach students how to use sensor and data integration techniques to coordinate the efforts of multiple aerial platforms. The MC-12W syllabus does not train aircrews to operate as airborne mission commanders and contains no training that focuses on controlling multi-aircraft packages and the rules of engagement for lethal ordnance delivery. In addition, the MC-12W training program contains only a few of the elements found in the Joint Firepower Course (JFC) course taught at Nellis Air Force Base, Nevada. The JFC teaches the tactics, techniques, procedures, and doctrinal requirements for coordinating and conducing CAS missions. As a result, MC-12W students have no formalized education dealing with airspace control measures, fire support coordination, basic bomb theory, weapon's effects, and the various terminal-control procedures used in CAS operations to clear aircraft for live ordinance delivery.

In Iraq and Afghanistan, the MC-12W Liberty is currently performing ISR and over-watch missions that closely mirror the training sorties flown in the stateside mission qualification course. The aircraft typically performs missions as a single-ship package and rarely integrates its operations beyond the level of simple de-confliction, target handoff, and ISR responsibilities coordination. Although MC-12W aircrews de-conflict their airspace from that of other supporting aircraft over the target area, they typically do not share sensor data or cue attack aircraft to targets. This is largely due to organizational factors that preclude additional training and prohibit commanders from taking full advantage of the MC-12W's inherent capability to perform additional missions beyond ISR.

LAAR Training and FAC(A) Qualification

In comparison to the MC-12W syllabus, the LAAR training course will produce pilots that are competent and capable in AI, CAS, FAC(A), and personnel recovery (PR) roles. Although the LAAR will perform multiple roles and missions, the FAC(A) qualification encompasses all of the skill sets required for any of the LAAR aircraft's anticipated mission areas. FAC(A)s are an extension of the Tactical Air Control Party (TACP). TACPs generally include a Joint Terminal Attack Controller (JTAC), Air Liaison Officer (ALO), and FAC(A).[88] TACPs are located with Army maneuver units from battalion to corps and may employ JTACs as low as the company and squad levels.[89] Although TACP at the corps and brigade level function primarily as liaisons, TACP units at the battalion level and lower are primarily responsible for providing terminal control for the delivery of live munitions during CAS missions. [90] The two members of the TACP with primary responsibility for providing terminal control during CAS missions are the JTAC and the FAC(A).

> A joint terminal attack controller (JTAC) is a qualified (certified) Service member who, from a forward position, directs the action of combat aircraft engaged in CAS and other air operations. A FAC(A) is a specifically trained and qualified aviation officer who exercises control from the air of aircraft and indirect fires engaged in close air support of ground troops. A certified and qualified JTAC or FAC(A) will be recognized across the Department of Defense as capable and authorized to perform terminal attack control.[91]

The FAC(A) acts as the airborne extension of the TACP. The FAC(A) extends the range that the TACP can detect, identify, and destroy targets while simultaneously acting as an additional controller who can either support a maneuvering ground force without a TACP, or

[88]Joint Chiefs of Staff, Joint Publication (JP) 3-09.3, *Close Air Support* (Washington, DC: Government Printing Office, 2009), II-9.

[89]Ibid.

[90]Ibid.

[91]Ibid.

supplement a TACP assigned to a maneuvering ground force commander.[92] As the airborne extension of the TACP, the FAC(A) must understand the essential elements of the ground scheme of maneuver as well as have a thorough knowledge of all prescribed Joint Publication 3-09.3 JTAC responsibilities. Ultimately, the FAC(A) meets the ground commander's intent by controlling CAS aircraft and accomplishing mission tasks including, reconnaissance, asset coordination and de-confliction, Suppression of Enemy Air Defenses (SEAD) coordination, radio relay, target marking, target designation, coordinate generation, Calls for Fire (CFF), Terminal Attack Control (Type I, II, and III), and Battle Damage Assessment (BDA).[93] This unique and daunting combination of responsibilities requires the use of highly proficient and well-trained aviators to ensure mission success and avoid fratricide. Joint doctrine specifically authorizes only FAC(A) qualified aircrew to provide joint, terminal-attack control during CAS operations.

In order to meet their unique responsibilities, joint doctrine demands that aircrew seeking FAC(A) qualification attend the Joint Fire Power Course (JFC) administered by the Air Ground Operations School (AGOS) at Nellis Air Force Base, Nevada. Administrators have divided the course into five separate syllabi in order to tailor the training an individual receives according to his or her tactical specialty.[94] The JFC provides students with a broad overview of Service Doctrine as well as the various methods used for integrating fires in a joint operating environment. The Forward Air Controller Joint Firepower (FACJFC) course is a subset of the JFC that utilizes the classroom setting as well as practical field exercises to teach specific tactics, techniques and procedures that provide students with a solid doctrinal foundation and in-depth

[92]Mathew J. Vedder, "FAC(A) Integration" (Student Paper, United States Air Force Weapons School, Nellis Air Force Base), 2.

[93]Ibid., 5.

[94]Department of the Air Force, *Joint Firepower Course* (Langley Air Force Base: Headquarters Air Combat Command, 2006), 2.

knowledge of current operating principles.[95] After completing the course, graduates posses the currencies and qualifications required to employ the tactics, techniques and procedures for planning, coordinating and executing joint fires.[96] They also possess the knowledge required to integrate CAS, artillery, and attack aviation into the ground commander's scheme of maneuver. Pilots must complete the (FACJFC) portion of the JFC before they can perform duties as a FAC(A).

In addition to the ground based JFC training, FAC(A) candidates also participate in an extensive flying training program administered at their home flying squadrons prior to achieving a mission ready status. The flying portion of the FAC(A) training course arms aviators with the skills required in supporting CAS operations from the cockpit. The syllabus is an extension of the standard Mission Qualification Training (MQT) that all attack pilots complete before flying their first combat sortie. During the MQT course, students learn advanced aircraft handling techniques, basic surface attack techniques, offensive and defensive air-to-air tactics, surface-attack tactics, and night operations. Students complete the eleven-flight MQT course before they begin the specialized training required to obtain the FAC(A) qualification. After completing the basic MQT course, students begin the six-flight flying portion of the FAC(A) course. During these sorties, students practice FAC(A) techniques suitable for controlling CAS operations in all threat environments including day, night, and inclement weather scenarios. The FAC(A) syllabus also includes approximately twenty additional hours of classroom instruction and six missions in an aircraft simulator.

The flying portion of the FAC(A) upgrade syllabus focuses on multiple joint mission tasks that upgrading pilots must be familiar with in order to maintain FAC(A) qualification. The first set of tasks focuses on planning, developing, and assessing CAS requirements in support of

[95]Ibid.

[96]Ibid.

the ground combat maneuver plan. To fulfill this requirement, aircrews participate in the Military Decision Making Process (MDMP) or Marine Corps Planning Process (MCPP) while coordinating the integration of surface fire support with CAS in support of the commander's concept of operations. Students must be adept at interpreting fire support coordination measures, integrating joint and component airspace control agencies, and interpreting airspace coordination measures and their impact on air support mission planning.

Based upon their knowledge of the enemy situation, ground order of battle (GOB), and the enemy air-defense posture, potential FAC(A) pilots plan CAS and SEAD missions in support of the ground combat maneuver plan. They also analyze potential targets in order to optimize their recommendations concerning CAS employment. Students must then demonstrate their ability to perform reconnaissance, locate, validate, and recommend suitable CAS targets in accordance with the ground commander’s intent. Upgrading aircrews provide advice to the ground maneuver commander concerning the proper employment of CAS assets. This requires a thorough knowledge of the capabilities and limitations of fixed wing, rotary wing, and remotely piloted CAS and FAC(A) assets. Students also assess the potential effects that weather, terrain, and air defense threats will have on CAS capabilities and modify their advice to the unit commander accordingly.

During the flying portion of their upgrade training, FAC(A) students employ live and simulated ordnance in order to support CAS and ground forces. Students must demonstrate the capability to de-conflict multiple aircraft and fires in the target area while simultaneously marking targets, delivering munitions, and coordinating for follow-on attacks. Qualified FAC(A) personnel are well versed in the various munitions and delivery techniques used to obtain desired weapons effects on the target. Students develop this knowledge along with a deep understanding of the rules of engagement (ROE) to effectively prosecute targets while mitigating the risk of collateral damage and fratricide. FAC(A) pilots also classify potential targets while simultaneously coordinating and controlling fires from multiple assets including artillery,

mortars, and naval surface fires. They also produce post-strike, battle damage assessments (BDA) and provide re-attack recommendations when appropriate.

The FAC(A) syllabus gives aircrew an in-depth knowledge of the planning and execution elements required to properly coordinate and execute lethal fire-support for ground forces engaged in maneuver operations. Unlike MC-12W aircrews, FAC(A) pilots are adept at integrating their operations into the MDMP and Marine Corps planning processes. They are also very well equipped to deal with a host of coordination issues that naturally arise during the close integration of aerial and ground-based fires on a rapidly changing battlefield.

Asset Utilization

The complexities inherent in the FAC(A) and ISR missions are not the only factors limiting the MC-12W Liberty and AT-6B's ability to share roles and missions. Limited MC-12W aircraft inventory, large aircrew-manning ratios, and a non-standard deployment timeline are also major factors prohibiting MC-12W aircrews from expanding their mission focus. Increased operations tempos at the tactical level have greatly increased the requirement for persistent ISR coverage of the battlefield. There are currently not enough ISR systems available to fulfill joint force commander driven requirements. The USAF initiated the MC-12W program as a means of quickly increasing the number of available ISR assets given an inability to increase UAV production schedules. This effort has resulted in thirty-seven additional aircraft supported by a manning construct designed to support expeditionary operations.

The USAF currently draws its MC-12W pilots and sensor operators from other airframes for a 180-day, deployed, tour of duty in the Liberty. Aircrews complete their mission qualification training before deploying to the USCENCOM AOR. The top two squadron leaders serve mandatory 365-day rotations in order to bolster unit cohesion and retain continuity. However, squadrons still experience a loss of corporate knowledge and unit cohesion as seasoned

aircrews rotate through the MC-12W community on a semi-annual basis. Because of the high personnel turnover rates, aircrews have no time to learn additional skills.

The MC-12W is, and the AT-6B will be, a low-density, high-demand asset. This situation will make it difficult for the USAF to expand the MC-12W's designated mission set due to limited training assets. Most USAF tactical squadrons are comprised of eighteen to twenty-four primary assigned aircraft (PAA). Previous experience has shown low PAA numbers combined with high aircrew-manning ratios negatively affect airframe availability and sortie generation. As a result, squadrons with few aircraft and a large number of assigned aircrew often experience difficulty keeping aircrew current in their primary mission tasks due to a dearth of training assets. In extreme cases, training can suffer to the point that safety issues override effective training. "Tactical Air Command and Pacific Air Forces leadership realized this when, between 1978 and 1984, they stopped rapidly declining mission capable rates by consolidating 18 PAA squadrons into 24 PAA squadrons."[97]

In order to meet combat requirements, the USAF has focused on increasing the total number of MC-12W aircraft available to the Joint Force Commander. As a result, the USAF plans to deploy twenty-six of the thirty-seven total MC-12W aircraft to combat units in the USCENTCOM AOR. These aircraft will deploy to as many as three different operating locations enabling the MC-12W squadrons to support operations in both Iraq and Afghanistan. This means each of the three combat squadrons may have as few as eight primary assigned aircraft. In addition to the twenty-six MC-12Ws slated for combat operations, the USAF will base five aircraft at a training location in the CONUS. Instead of creating a new MC-12W training wing, the USAF has placed the training aircraft under the supervision of a parent wing. This is because the small number of training assets does not justify the formation of a separate organization. The

[97]Shaun R. McGrath, "Leveraging Simulation Against the F-16 Flying Training Gap" (Master's Thesis, Air University, Maxwell Air Force Base, AL, 2005), 362.

186th ARW in Meridian, Mississippi administers the MC-12W training program. Although the 186th ARW currently operates the KC-135 aerial refueling tanker as its primary mission, it has taken on the additional responsibility of training MC-12W aircrews for their ISR role. The USAF will allocate the six remaining aircraft based upon operational requirements at the time the aircraft roll off the assembly line. Therefore, it is likely that none of the MC-12W squadrons will have more than ten primary assigned aircraft.

The MC-12W Liberty's aircrew-manning ratio will also contribute to its inability to increase training. Legacy-fighter platform manning is typically 1.25 aircrew per aircraft. A typical combat squadron contains between twenty-five and thirty-two authorized pilots. ACC is setting the MC-12W aircrew-manning ratio at five aircrews per aircraft.[98] Since a single MC-12W aircrew consists of four personnel, a 5:1 aircrew-manning ratio will force the USAF to train twenty individuals for each MC-12W in its inventory.[99] Therefore, the Air Force will require 740 personnel to properly man entire the MC-12W fleet. Under this construct, two-hundred personnel may rotate through a ten-aircraft combat squadron in less than a year. This large personnel pool will enable the USAF to continuously deploy a steady stream of airman to conduct combat operations while simultaneously avoiding the stress created by long tours of duty under combat conditions. However, the training tempo created by this manning construct leaves few available training assets and little additional capacity for developing skill sets beyond those required for basic mission qualification.

In order for the USAF to train five aircrews for each of its thirty-seven MC-12W aircraft, it will have to train 185 aircrews. Each aircrew will require twelve sorties just to achieve basic mission qualification status. This will require 2,220 training sorties. Using the five aircraft

[98]Headquarters Air Combat Command, "Project Liberty Update (Topic 1)" (Briefing, Langley Air Force Base, 2009).

[99]Ibid.

assigned to the 186th ARW, each aircraft will be required to fly 444 sorties in a six-month period (aircrews currently serve only six months in the MC-12W).[100] Assuming the aircraft are able to fly at least twenty days per month, each aircraft will have to fly three to four sorties per day. Assuming the training unit gets all six of the aircraft still under construction and not yet allocated to the combat squadrons, each training aircraft will still have to fly 1.7 missions per day just to meet basic mission qualification requirements. The training load only falls to a manageable 1.18 sorties per aircraft, per day, after subtracting permanent-party training aircrews and limiting the combat fleet is to twenty-six aircraft. As a result, there is no room in the current manning construct to include any additional training requirements. However, as operational requirements ease and more MC-12W aircraft enter the USAF inventory, the current concept of operations may change.

Future MC-12W concepts of operation change both the number of deployed aircraft and the aircrew-manning ratio to help ease the training load and increase the system's ability adapt to new training requirements. Instead of deploying up to thirty-two aircraft in continuous combat operations, the USAF would only forward deploy fourteen aircraft while allocating the remaining twenty-three aircraft to a training wing located in the CONUS.[101] In addition, the aircrew-manning ratio would drop from 5:1 to more manageable 2.5:1 aircrews per aircraft.[102] A change to permanent party basing at deployed locations will enable this new manning construct. Under the new program, aircrews would serve a standard two or three year tour of duty in the MC-12W. During their tour in Liberty squadron, aircrews would spend one year at their home station for every six months deployed on combat operations.[103] These changes would enable the USAF to

[100]Ibid.

[101]Ibid.

[102]Ibid.

[103]Ibid.

increase both aircrew proficiency and available training assets. Although the MC-12W will remain a low-density, high-demand asset, these measures would ensure MC-12W program remains flexible enough to adapt to the changing operating environment.

Conclusions and Recommendations

In its attempt to produce cost effective solutions to joint force requirements in Iraq and Afghanistan, the USAF may field two aircraft with the technical capability to share missions and perform highly integrated operations. Although engineers designed the LAAR aircraft as a light attack platform, its sensor and communications architecture gives it the capability to collect imagery and perform ISR missions. Similarly, the MC-12W's sensors and communications suite gives it the technical capability to perform FAC(A) missions. However, the MC-12W aircraft's design makes it difficult for aircrews to gain and maintain visual situational awareness of friendly and enemy ground forces. In addition, MC-12W aircrews are not trained in basic weapons employment techniques. Therefore, although a potential exists for the two aircraft to integrate their operations in order to provide enhanced lethal and non-lethal effects across the battlefield, factors including aircraft design, aircrew training, and crew-manning ratios currently inhibit this potential.

The LAAR aircraft's performance, weapons payload, avionics, and sensors make it an ideal ground-attack platform for COIN operations. However, the LAAR aircraft's ISR capabilities are limited when compared to aircraft like the MC-12W. Despite its advanced sensor array and robust communications suite, the AT-6B lacks the capability to transmit streaming data over long distances without the aid of a third-party repeater somewhere on the battlefield. The LAAR aircraft also has no SIGINT capability. In addition, the LAAR has only limited data storage and transmission capabilities compared to the MC-12W Liberty. However, the aircraft can transmit imagery and geographic location data to multiple echelons throughout the AOR using its SADL data link. Although the LAAR aircraft may be useful to fill gaps in ISR coverage

when there are no other available assets, the aircraft is far better suited to its intended role as a light-attack, armed-reconnaissance aircraft.

Similarly, the MC-12W system is well equipped to carry out its role as a theater and tactical level ISR asset although it is unlikely to perform other missions. The aircraft's blend of electro-optical, infrared, and SIGINT sensors allow it to collect multiple forms of intelligence while its impressive communications and information transmission systems allow it to transmit data simultaneously to multiple echelons while directly supporting engaged ground forces at the tactical level. The aircraft's small logistic tail and long loiter capability make it an excellent, low-cost, ISR alternative to manned legacy platforms. The aircraft's ability to operate from small, austere, operating locations also provides it the flexibility to serve as a capacity building asset for international partners engaged in COIN operations. Although the MC-12W's sensor and communications systems provide the aircraft with a technical capability to perform FAC(A) missions, aircrews suffer from poor visibility and a complete lack of training in CAS operations in comparison to the LAAR and legacy-fighter aircraft. In addition, the absence of either a LINK-16 or SADL data link interface limits the aircrew's ability to gain an over-all awareness of the disposition of forces across the battlefield. Finally, the absence of an offensive, forward-firing weapons capability reduces the aircraft's utility as a target-marking and attack-support platform. These factors all prohibit the MC-12W from effectively performing FAC(A) missions in environments where hostile and friendly forces operate in close proximity. As a result, it will be difficult for MC-12W aircrews to effectively perform roles and missions beyond ISR. This is due to aircraft design as well as a combination of aircrew manning and training issues.

Aircraft technical factors are not the only issues hindering the LAAR aircraft and MC-12W Liberty's ability to assume new roles and missions. The USAF has designed each system's respective training program to prepare aircrew to perform either the ISR or ground-attack mission. These specific training regimens preclude aircrew from easily assuming new roles and responsibilities without additional training. In its current form, the MC-12W training syllabus

does not prepare aircrew to manage airspace and fire control measures for multiple strike aircraft. In fact, the current training fails to include any aircraft integration at all beyond simple target hand-off and airspace de-confliction procedures. In addition, MC-12W aircrews are not qualified to make collateral damage estimates or provide joint, terminal-attack control. The MC-12W training program will require extensive additional classroom and in-flight training in order to prepare aircrew for the FAC(A) role. LAAR aircrew will find it much simpler to assume ISR duties. Although the FAC(A) syllabus already teaches the skills required to find, fix, and track a target, LAAR aircrew will still require additional training in non-traditional ISR techniques in order to effectively perform the ISR role.

MC-12W crew-manning ratios and deployment schedules also make it difficult for aircrews to assume new roles and missions. The USAF currently uses the five MC-12W training aircraft stationed in the CONUS to provide mission qualification training to the large numbers of aircrew preparing to deploy to the USCENTCOM AOR. When the aircrews arrive at their deployed locations, factors such as short deployment periods, large personnel numbers, and few available airframes, conspire to limit available training resources. The LAAR aircraft will likely face similar difficulties due to its status as a high-demand, low-density asset. However, as the demand for the MC-12W and LAAR in the USCENTCOM AOR begins to wane with the redeployment of combat forces to the CONUS, USAF plans to change the manning and deployment construct for the MC-12W will enable aircrews to accomplish additional training due to increased asset availability. Lower crew-manning ratios and larger numbers of primary assigned aircraft per squadron will enable the USAF to expand training programs to accommodate additional roles and missions.

Although the MC-12W and LAAR aircraft should not assume additional roles and missions due to the previously mentioned technical, aircrew training, and aircrew-manning factors, the two platforms can still integrate elements of their combat operations. Both aircraft can link into the ISRD in order to provide the Joint force commander with real-time intelligence data.

In addition, the LAAR and MC-12W aircraft can effectively operate in multi-aircraft packages in order to provide tactical ISR capabilities coupled with lethal effects. Packaged integration will enable the joint force commander to leverage both platforms' strengths in order to gain multi-domain situational awareness of multiple targets while utilizing the lethal effects provided by the LAAR. During multi-aircraft packaged operations, LAAR aircrews would act as the package commanders. LAAR aircrew would possess the expertise required to coordinate fires, de-conflict airspace, and simultaneously ensure unity of command and unity of effort for all of the assets included in the package. However, due to the limited number of available assets, these packaged missions will most likely remain the exception rather than the rule.

In conclusion, disparate MC-12W and LAAR aircraft procurement, organization, and training programs currently preclude the USAF from realizing the potential benefits of integrating its growing inventory of low-cost, off-the-shelf aircraft. This author recommends future researchers examine the possibility of integrating the MC-12W and LAAR aircraft into a single counterinsurgency-focused wing organization. A single COIN wing organization may create streamlined training, maintenance, and personnel practices enabling units to meet rapidly shifting requirements in the contemporary operating environment. A common wing structure would almost certainly create increased capacity for accomplishing integrated flight training thereby allowing aircrews to develop new tactics, techniques and procedures leveraging the synergistic capabilities of the two aircraft. A single consolidated wing structure would also engender the trust and confidence vital to integrated operations. The LAAR and MC-12W aircraft both represent a radical shift in a USAF approach to the manned, tactical aircraft procurement philosophy that has been in place since the Reagan era. Instead of a single, expensive, multi-mission platform designed to meet multiple requirements, the USAF is now fielding aircraft specifically designed to provide inexpensive solutions in individual mission areas. However, the urgent operational needs of the joint force have compelled the USAF to rush the MC-12W into the current fight in a piece meal fashion. If this trend continues, the USAF will fail to realize the full potential of these

aircraft. However, with slight modifications to current organization and training constructs it may still be possible for the aircraft to assume additional pieces of the COIN mission.

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